

## WHAT IS CLAIMED IS:

1. An optical system, comprising:

5 a plurality of optical surfaces including a first surface on which light rays from an object are incident and which has at least a reflective action, and a second surface reflecting the light rays reflected by the first surface back toward the first surface;

10 wherein the first surface reflects a central field-angle principal ray, which comes from the second surface and is again incident on the first surface, to the opposite side of the previous reflection with respect to a normal at a hit point of the central field-angle principal ray on the first surface; and

15 wherein the plurality of optical surfaces includes a diffractive optical surface.

2. The optical system according to claim 1,

20 wherein the first surface is decentered with respect to the light rays from the object.

3. The optical system according to claim 1,

wherein the second surface is the diffractive optical surface.

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4. The optical system according to claim 1,

wherein the first surface and the second surface are

formed on a transparent member filled with an optical medium.

5. The optical system according to claim 1,

wherein the diffractive optical surfaces is one of the  
5 plurality of optical surfaces other than the first and the  
second surface.

6. The optical system according to claim 5,

wherein the first and the second surfaces are formed on  
10 a first transparent member filled with an optical medium; and  
wherein the diffractive optical surface, which is not  
the first or the second surface, is formed on a second  
transparent member filled with an optical medium.

15 7. The optical system according to claim 1,

wherein the diffractive optical surface is a  
rotationally symmetric curved surface and has a phase  
distribution on the curved surface.

20 8. The optical system according to claim 7,

wherein the phase distribution is rotationally  
symmetric.

9. The optical system according to claim 7,

25 wherein the phase distribution is rotationally  
asymmetric.

10. The optical system according to claim 1,  
wherein the diffractive optical surface is a  
rotationally asymmetric curved surface and has a phase  
distribution on the curved surface.

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11. The optical system according to claim 10,  
wherein the phase distribution is rotationally  
symmetric.

10 12. The optical system according to claim 10,  
wherein the phase distribution is rotationally  
asymmetric.

13. The optical system according to claim 1,  
15 wherein the diffractive optical surface has a  
reflective action.

14. The optical system according to claim 1,  
wherein the diffractive optical surface has a  
20 transmissive action.

15. The optical system according to claim 1,  
wherein the light rays from the object form an  
intermediate image inside the optical system.

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16. The optical system according to claim 15,  
wherein the diffractive optical surface is arranged

between the object and the intermediate image.

17. The optical system according to claim 16,

5 wherein the diffractive optical surface is provided at a position which is closer to a pupil image-forming position of the light rays from the object than to the object.

18. The optical system according to claim 1,

further comprising a third surface;

10 wherein the first, the second and the third surface are formed on a transparent member filled with an optical medium;

wherein the light rays incident on the transparent member emerge from the transparent member after traveling along an optical path including being transmitted through the 15 third surface, being reflected at the first surface, being reflected at the second surface, being reflected at the first surface, being reflected at the third surface, and being transmitted through the first surface.

20 19. The optical system according to claim 18,

wherein the following condition is satisfied:

$$|\theta| < 60^\circ$$

where  $\theta$  is an angle formed by the central field-angle principal ray which is first incident on the second surface 25 after being reflected by the first surface and its reflected light ray.

20. The optical system according to claim 1,  
further comprising a third surface;  
wherein the first, the second and the third surface are  
formed on a transparent member filled with an optical medium;  
5 wherein the light rays incident on the transparent  
member emerge from the transparent member after traveling  
along an optical path including being transmitted through the  
first surface, being reflected at the third surface, being  
reflected at the first surface, being reflected at the second  
10 surface, being reflected at the first surface, and being  
transmitted through the third surface.

21. The optical system according to claim 20,  
wherein the following condition is satisfied:

15  $|\theta| < 60^\circ$   
where  $\theta$  is an angle formed by the central field-angle  
principal ray which is first incident on the second surface  
after being reflected by the first surface and its reflected  
light ray.

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22. The optical system according to claim 1,  
further comprising a third surface;  
wherein the first, the second and the third surface are  
formed on a transparent member filled with an optical medium;  
25 wherein the light rays incident on the transparent  
member emerge from the transparent member after traveling  
along an optical path including being transmitted through the

third surface, being reflected at the first surface, being reflected at the second surface, being reflected at the first surface, being reflected at the second surface, being reflected at the first surface, being reflected at the second surface, being reflected at the third surface, and being transmitted through the first surface.

5        23. The optical system according to claim 22,  
          wherein the following condition is satisfied:

$$|\theta| < 60^\circ$$

10      where  $\theta$  is an angle formed by the central field-angle principal ray which is first incident on the first surface after being reflected by the second surface and its reflected light ray.

15      24. The optical system according to claim 1,  
          further comprising a third surface;  
          wherein the first, the second and the third surface are formed on a transparent member filled with an optical medium;  
          wherein the light rays incident on the transparent  
20      member emerge from the transparent member after traveling along an optical path including being transmitted through the first surface, being reflected at the third surface, being reflected at the first surface, being reflected at the second surface, being reflected at the first surface, being reflected at the second surface, being reflected at the first surface, and being transmitted through the third surface.

25. The optical system according to claim 24,  
wherein the following condition is satisfied:

$$|\theta| < 60^\circ$$

where  $\theta$  is an angle formed by the central field-angle  
5 principal ray which is first incident on the first surface  
after being reflected by the second surface and its reflected  
light ray.

26. A display optical system, comprising;  
10 an image-forming device forming an original image; and  
an optical system according to claim 1 guiding light  
rays from the original image to a viewer's eye or to a  
projection surface.

15 27. An image-taking optical system comprising:  
a photoelectric conversion device;  
an optical system according to claim 1 forming an  
object image on a light-receiving surface of the  
photoelectric conversion device.

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